Quality of Care for Patients Diagnosed With Diabetes at Screening

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OBJECTIVE — Screening for diabetes has the potential to be an effective intervention, especially if patients have intensive treatment of their newly diagnosed diabetes and comorbid hypertension. We wished to determine the process and quality of diabetes care for patients diagnosed with diabetes by systematic screening.

RESEARCH DESIGN AND METHODS — A total of 1,253 users of the Durham Veterans Affairs Medical Center aged 45–64 years who did not report having diabetes were screened for diabetes with an HbA_{1c} test. All subjects with an HbA_{1c} level ≥6.0% were invited for follow-up blood pressure and fasting plasma glucose (FPG) measurements. A case of unrecognized diabetes was defined as HbA_{1c} ≥7.0% or FPG ≥126 mg/dl. For each of the 56 patients for whom we made a new diagnosis of diabetes, we notified the patient's primary care provider of this diagnosis. One year after diagnosis, we reviewed these patients' medical records for traditional diabetes performance measures as well as blood pressure. Follow-up blood pressure was also ascertained from medical record review for all subjects with HbA_{1c} ≥6.0% who did not have diabetes. We compared blood pressure changes between patients with and without diabetes.

RESULTS — Among patients diagnosed with diabetes at screening, 34 of 53 (64%) had evidence of diet or medical treatment for their diabetes, 42 of 53 (79%) had HbA_{1c} measured within the year after diagnosis, 32 of 53 (60%) had cholesterol measured, 25 of 53 (47%) received foot examinations, 29 of 53 (55%) had eye examinations performed by an eye specialist, and 16 of 53 (30%) had any measure of urine protein. The mean blood pressure decline over the year after diagnosis for patients with diabetes was 2.3 mmHg; this decline was similar to that found for 183 patients in the study without diabetes (change in blood pressure, −3.6 mmHg). At baseline, 48% of patients with diabetes had blood pressure <140/90, compared with 40% of patients without diabetes; 1 year later, the same 48% of patients with diabetes had blood pressure <140/90, compared with 56% of patients without diabetes ($P = 0.31$ for comparing the change in percent in control between groups).

CONCLUSIONS — Patients with diabetes diagnosed at screening achieve less tight blood pressure control than similar patients without diabetes. Primary care providers do not appear to manage diabetes diagnosed at screening as intensively as long-standing diabetes and do not improve the management of hypertension given the new diagnosis of diabetes.

Diabetes Care 26:367–371, 2003

There is disagreement among expert organizations regarding the value of asymptomatic diabetes screening. The American Diabetes Association recommends screening for all adults ≥45 years of age, with high-risk people to be screened at a younger age (1). However, other evidence-based organizations do not recommend screening (2). One decision analysis finds screening to be of borderline cost-effectiveness (3).

Diabetes screening cannot be cost-effective unless diabetes treatment is effective for those identified at screening. Diabetes screening would presumably "work" by identification of new cases of diabetes, who would then receive appropriate complication screening (e.g., periodic eye examinations) and improved glycemic control earlier in the natural history of their disease. Both complication screening and tight glycemic control are effective in preventing microvascular complications of diabetes (4,5). However, a crucial element of comprehensive diabetes treatment is the treatment of comorbid hypertension. Blood pressure control has been shown to reduce cardiovascular morbidity and improve quality of life in patients with diabetes (6,7). Furthermore, blood pressure should be treated to a lower target (i.e., 130/85) in patients with diabetes than in individuals without diabetes (7,8). Therefore, diabetes screening could also "work," perhaps even more effectively than through improved glycemic control, by identifying patients requiring more aggressive blood pressure management and achieving lower targets.

Our objective in this study was to assess the quality of management of diabetes and hypertension in patients with diabetes identified at screening.

RESEARCH DESIGN AND METHODS

Patients

We identified all patients aged 45–64 years who had made an outpatient visit at the Durham Veterans Affairs Medical Center (DVAMC) between October 1996 and March 1999. We sent all of these patients a one-page questionnaire that asked if the patient had diabetes and if we could contact them by telephone for a research study. Respondents who denied knowledge of diabetes or "high blood glucose" and agreed to be telephoned were contacted for enrollment into the study.

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Received for publication 25 April 2002 and accepted in revised form 29 October 2002.

This work was funded by the Department of Veterans Affairs Cooperative Studies Program, study no. CSP 705-D. D.E. was funded by a VA HSR&D Career Development Award.

Abbreviations: DBP, diastolic blood pressure; DVAMC, Durham Veterans Affairs Medical Center; FPG, fasting plasma glucose; SBP, systolic blood pressure.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Diabetes screening protocol

Before enrollment, we obtained written informed consent from all subjects. The Institutional Review Board of the DVAMC approved the study and enrollment strategy. At the initial visit, we excluded patients who said they had diabetes, had had a prescription filled at the DVAMC pharmacy for a hypoglycemic medication, had a short life expectancy (incurable cancer or heart or lung disease requiring oxygen), or had no easy access to a telephone. We obtained HbA_{1c} measures on all subjects. All subjects with HbA_{1c} ≥6.0% were invited back for a follow-up fasting plasma glucose (FPG). All laboratory results were recorded in the DVAMC electronic medical record and hospital information system in the same fashion that any other laboratory studies were recorded.

We defined a case of diabetes as HbA_{1c} ≥7.0% or FPG ≥7 mmol/l (126 mg/dl). Although screening and diagnosis of diabetes by means of HbA_{1c} is not standard, the approach was used for two reasons. First, the convenience of performing a nonfasting test allowed rapid enrollment of patients into the study. Second, the nonfasting test mimics a reasonable strategy that might be used by a medical center to perform mass screening of patients whether or not they are fasting. At the conservative diagnostic cut point that we chose for further evaluation (HbA_{1c} 6.0%, 2 SDs above mean and the upper limit of normal on standard machines) and in a screening population, the sensitivity of HbA_{1c} for the diagnosis of diabetes is 75–93% (9,10). We asked patients with a new diagnosis of diabetes for their permission to communicate the diagnosis to the primary care provider by e-mail, or by telephone for patients with primary care providers outside the VA health system; all but one assented.

Outcome measures and covariates

At the visit where the follow-up FPG was obtained (after an initial HbA_{1c} ≥6.0%), patients had their blood pressure, fasting serum lipids, and urine albumin measured. A nurse using a manual cuff measured blood pressure in the seated position after resting for 5 min.

Comprehensive chart review for the year after diagnosis was performed for the patients found to have diabetes at screening. Electronic and paper medical records at the DVAMC were obtained for all patients. In addition, for patients indicating that they received primary care at a Veterans Affairs Medical Center that was not Durham, their electronic medical records from that Veterans Affairs Medical Center were also reviewed. Finally, for patients not receiving primary care in the VA at all, we requested all paper medical records from their primary care provider and reviewed those records.

We ascertained the following diabetes quality of care measures: for glycemic management, the measurement of HbA_{1c}; for eye care, referral to an eye clinic, a completed visit to an eye clinic, or mention in a note of a visit to an outside eye care provider; for foot care, mention of a foot examination with assessment of sensation; for lipid management, measurement of LDL cholesterol; and for kidney protection, quantitative measurement of urine protein (not urinalysis). Completion rates of the above processes were compared with completion rates of the same processes obtained from patients not enrolled in the study, but for whom quality assurance data were collected in the same year as our study as part of routine hospital function. These "benchmark" patients (n = 238) represent a cohort of patients in our institution with established diabetes, and they are selected randomly. An independent review board performing standardized medical record review obtained quality assurance data for these benchmark patients.

To assess hypertension management, we recorded the blood pressure closest in time to the date 1 year after enrollment. Blood pressure changes in the group with diabetes diagnosed at screening were compared with a group of patients enrolled in our study with HbA_{1c} ≥6.0% but FPG <126 mg/dl. These patients also had blood pressure measured at baseline as part of the study, and we recorded their blood pressure a year later from the medical record in a manner identical to that used for our patients with diabetes. This control group was chosen because we had ascertained blood pressure for them in the same manner as for our group of interest.

To further assess management of hypertension, we also recorded changes in blood pressure medication for patients on any antihypertensive medication during the follow-up year. Changes were recorded for both the diabetic patients and the enrollees without diabetes used in the blood pressure analysis. We considered a blood pressure medication regimen to be "intensified" if there was either the addition of a new antihypertensive medication or an increase of dosage in an existing medication, and there was no concomitant removal of or decreased dosage in another antihypertensive medication.

Analysis

Bivariate comparisons of quality of care outcomes were performed using McNemar's test for paired binary data. Rates of blood pressure intensification were compared by the χ^2 test. Blood pressure was compared between our two groups by the t test on mean arterial blood pressure (mean arterial blood pressure = [systolic + (2 × diastolic)]/3), a physiologically relevant combination of systolic blood pressure (SBP) and diastolic blood pressure (DBP) often used in similar analyses (11,12). We assessed the effect of diabetes on blood pressure independent of baseline blood pressure using ANCOVA. In this analysis, follow-up blood pressure was the dependent variable; baseline blood pressure and diabetic status were the only covariates in the model. Because the clinical relevance of lowering blood pressure once it is below the target threshold is questionable, as a sensitivity analysis, we also compared the percentage of patients with blood pressure "in control" (SBP <140 mmHg *and* DBP <90 mmHg) between groups by logistic regression. Missing data were handled both by case deletion and by multiple imputation methods; the results did not differ, and the multiple imputation results are presented here (13). Most analyses were performed using the SAS V 8.0 analysis system (SAS, Cary, NC); models requiring multiple imputation were performed using S-PLUS statistical software (Insightful) and NORM (www.stat.psu.edu/~jls).

RESULTS

Patients

The details of patient flow through the protocol have been described previously (14). We screened 1,253 patients and found 56 new cases of diabetes. Table 1 shows the baseline characteristics of the patients found to have diabetes at screening. Approximately 70% of patients were white, and ~75% were receiving primary care at the DVAMC. The patients had a high burden of illness, as noted by the very low quality of life scores; these scores

Table 1—*Baseline demographic and clinical characteristics of study patients*

	Screened (+) for diabetes	Screened (−) for diabetes	Comparison group for blood pressure*
n	56	1,177	183
Demographic characteristics			
Age	55 ± 6	55 ± 6	55 ± 5
Male sex	96	94	99
Race			
White	70	69	45
African-American	30	29	55
Other	0	2	0
Family history of diabetes	50	37	46
Reported primary care at DVAMC	75	72	69
Clinical characteristics			
Body weight >120% of ideal	79	59	69
Diagnosis of hypertension	73	52	62
SF-36 physical component score	36 ± 11	36 ± 12	35 ± 12

Data are means ± SD or % unless otherwise indicated. *n* = 1,253. *Comparison group for blood pressure determination were all patients in the study with 6.0% ≤ HbA_{1c} ≤ 6.9% and FBG < 126 mg/dl. SF-36, Short Form 36.

were more than 1 SD lower than what is seen in non-VA outpatient populations (15). The race of the patients, as well as the clinical characteristics, were typical for studies of outpatients using VA medical centers (16).

Quality of care

Patients diagnosed at screening received fewer procedures associated with quality of diabetes care than patients with established diabetes. The results are in Table 2. Patients diagnosed at screening got statistically significantly fewer processes associated with quality of diabetes care than patients with established diabetes for every measure we obtained, including measurement of HbA_{1c} and fasting lipid panel, dilated eye, and foot examinations, and quantitative measures of urine protein. Despite provider notification and access to laboratory testing data, only 38 of 53 (72%) patients had any acknowledgment of the diagnosis or any form of treatment of diabetes noted in their medical records.

In an effort to assess whether this inadequate quality of care was due to a delay between diagnosis and presentation to the primary care provider, we also ascertained processes associated with high-quality diabetes care in the second year after diagnosis. There were no significant differences between year 1 and year 2 processes of care for our patients. To further assess whether this difference in quality of care was due to lack of opportunity to perform these measures, we counted the number of visits by study patients with diabetes to their primary care providers and to health care providers overall. The median number of annual visits to the primary care physician was 3, and the median number of visits to any provider was 11. Only 4 of 54 patients in year 1 and 1 of 53 patients in year 2 had no visits to a primary care physician. Therefore, there was ample opportunity for providers to perform appropriate diabetes quality of care measures in the patients with diabetes diagnosed at screening.

Table 2—*Quality of diabetes care for patients after diabetes discovered at screening*

	Screening patients, year 1	Screening patients, year 2	Benchmark patients*
n	53	53	238
HbA_{1c} measured	79	74	98
LDL cholesterol measured	60	58	87
Foot examination	47	55	90
Eye examination	55	58	74
Urine protein	30	40	34

Data are % unless otherwise indicated. $P > 0.05$ for all comparisons between year 1 and year 2. *Benchmark patients are those with established diabetes who were randomly selected by an external peer-review organization to assess VA compliance with quality of care parameters.

Blood pressure analysis

Because so many of our patients had hypertension and because the diagnosis of diabetes obligates lower blood pressure targets in patients with coincident hypertension, we chose to determine whether patients with the new diagnosis of diabetes would achieve tighter blood pressure control than our patients screening negative (Table 3). The comparison patients, again, were 126 study patients with HbA_{1c} ≥6.0% but FPG ≤125 mg/dl. There was no difference between the two groups in baseline and follow-up blood pressure. Both groups experienced a drop in blood pressure over the first year, with a mean blood pressure decline of 3.4 mmHg for patients screening negative for diabetes and 2.3 mmHg for patients screening positive. The diabetic group experienced no further decline in blood pressure in the second year after screening.

To further determine whether clinical differences between the groups confounded the relationship between diabetic status and blood pressure, we performed ANCOVA. After adjusting for baseline blood pressure, patients with diabetes had mean arterial blood pressure 1.7 mmHg higher at 1 year than patients without diabetes (95% CI −1.8 to 5.1). This model did not change significantly when prior diagnosis of hypertension was added to the model.

We also compared percentage of patients in control of their diabetes at baseline and 1 year later (Table 3). At baseline, 40% of patients with diabetes were in control (again, SBP <140 mmHg and DBP <90 mmHg) compared with 48% of patients without diabetes. However, 1 year later, the proportion of patients with diabetes whose blood pressure was in control remained 48%, whereas 56% of patients found not to have diabetes at screening were in control. In analyses that adjusted for baseline control status, patients with diabetes were no more likely to be in control than patients without diabetes (odds ratio 0.7, 95% CI 0.4–1.4). These results did not change markedly if

Table 3—*Blood pressure for patients diagnosed with diabetes at screening and a comparison population with HbA_{1c} ≥6.0% but without diabetes*

	Baseline				Year 1			
	SBP	DBP	Mean	PCT	SBP	DBP	Mean	PCT
Screened (+) for diabetes (HbA_{1c} ≥7.0% or FBG ≥126 mg/dl)	139.6	81.1	100.6	40%	137.7	79.3	98.7	56%
Comparison group (6.0% ≤ HbA_{1c} ≤ 6.9% and FBG <126 mg/dl)	138.9	82.2	101.2	48%	136.0	78.6	97.7	48%

For blood pressure comparisons, $P < 0.001$ between year 0 and year 1 for both groups. For PCT, $P > 0.3$ for comparison between groups. PCT, % under control (SBP <140 mmHg and DBP <90 mmHg).

prior diagnosis of hypertension was added to the model, nor was there a significant difference if we defined control as both SBP <130 mmHg and DBP <85 mmHg. To assess the possibility that the lack of difference occurred not because of passive management but because patients with diabetes were more difficult to control, we compared intensification of antihypertensive medications between the two groups. We found no difference; 17 of 41 patients in the diabetic group had their medication regimen intensified over the follow-up year (41%) compared with 42 of 119 (35%) subjects in the comparison group ($P = 0.50$). In both groups, more patients were out of control than had medication regimens intensified.

CONCLUSIONS — Diabetes screening cannot be an effective intervention unless patients diagnosed with diabetes at screening and their providers collaborate to address important quality of care indicators (e.g., blood pressure control) shown to improve outcomes. In this study, we screened 1,253 outpatients at the DVAMC for diabetes, and found 56 cases. Despite the fact that primary care physicians were notified of the diagnosis, traditional processes used to measure quality of diabetes care were performed less frequently for these patients than for patients with established diabetes at the DVAMC. This relatively poor quality of care seems to indicate that either providers, patients, or both do not view diabetes found at screening with the same seriousness as they view "established" diabetes. This suggests that health care organizations that attempt diabetes screening interventions will have to couple screening efforts with more attention to intensive treatment for patients identified with diabetes at screening.

Most importantly, patients with diabetes did not achieve lower blood pressures than a comparison group with hyperglycemia but without overt diabetes. Both groups achieved a significant drop in blood pressure of 2–4 mmHg. However, that drop may be due to the method of blood pressure ascertainment rather than true biological difference. We obtained baseline blood pressures by standard manual sphygmomanometry. Follow-up blood pressures were ascertained from the medical record, and blood pressures in our clinics were obtained by electronic dynamometers through sleeved arms, a method that has been shown to record pressures ~3 mmHg lower than standard methods (17). The blood pressure results are important to the discussion of the value of diabetes screening. Because the treatment of hypertension in patients with diabetes has been shown to reduce cardiovascular morbidity and improve quality of life (6,7), and target blood pressures are lower for patients with diabetes, it would make sense that the diagnosis of diabetes would trigger more aggressive treatment of blood pressure. The fact that we do not see this change in blood pressure suggests that the strategy of screening and communicating the results to a responsible provider may be inadequate to maximize the effectiveness of diabetes screening. This may mean that diabetes screening will not be cost-effective in "real-world" settings, but it may also mean that screening protocols should be coupled with other interventions to improve hypertension management.

The study has several limitations. Our data are from a single site and therefore reflect quality of care concerns that may not generalize to other locations in the health care system. However, this is mitigated by the fact that quality of diabetes care in the VA in general, and at the DVAMC in particular, is much better than in other systems in which these data are reported (18). This makes it unlikely that the problem of inadequate follow-up of diabetes diagnosed at screening is a problem isolated to the DVAMC. Another possible limitation is that our pragmatic definition of diabetes may have led to physicians not offering patients high-quality diabetes care because further testing suggested that patients did not have diabetes (and therefore eye examinations, etc., were unnecessary). However, most patients in the study (46/53, 87%) either had follow-up testing confirming the diagnosis or were managed as if they had diabetes. Thus, it seems likely that the primary difference was lack of adequate concern for diabetes in this group of patients diagnosed at screening or lack of acknowledgment of early diabetes rather than lack of true diabetes.

Our blood pressure analysis has two major limitations. First, in any study that fails to find an association, statistical power may be an issue. However, the CIs around the difference in blood pressure between patients with and without diabetes (−1.8 to 5.1 mmHg) indicate that there is a low likelihood that the patients with diabetes saw their blood pressures drop by even as much as two points more than the comparison group, despite the fact that their target blood pressures are significantly lower. Our study leaves open the possibility that patients diagnosed with diabetes at screening have an important (as much as 5 mmHg) *rise* in their blood pressure in the year after diagnosis, compared with patients without diabetes. Finally, comparison patients for the blood pressure analysis were not selected randomly but were a sample of patients who underwent the same screening protocol. Therefore, it is possible that the lack of difference between the two groups represents not a lack of effort by providers but greater difficulty in achieving blood pressure control in patients with diabetes. The similarity in medication intensification rates, however, suggests that the lack of difference between the two groups is more likely due to similar management of similar biology rather than more aggressive management of more pathological hypertension.

Our study demonstrates that the diagnosis of diabetes at screening has little

impact on blood pressure management for these newly diagnosed patients. The screened group also received poorer quality of diabetes care than patients with established diabetes, even 2 years after diagnosis. Health care providers interested in adopting diabetes screening interventions may want to reconsider the advisability of instituting screening in the absence of interventions to ensure appropriate quality care for the patients found to have diabetes.

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